

T15D09 – Enthalpy Changes of Rxn Practice MS

1. (a) the enthalpy/energy/heat change for the formation of one mole of a compound/substance from its elements;
in their standard states/under standard conditions/at 298 K and 1 atm;
 $\frac{1}{2} \text{H}_2(\text{g}) + \frac{1}{2} \text{N}_2(\text{g}) + 1\frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{HNO}_3(\text{l});$ 4
*Award [1] for correctly balanced equation, [1] for all state symbols correct.
Do not award equation mark if 2HNO_3 formed.*
- (b) $\Delta H_r = \sum \Delta H_f^\ominus (\text{products}) - \sum \Delta H_f^\ominus (\text{reactants})/\text{suitable cycle};$
 $= 3(-394) + 2(-286) - 185;$
Award [1] for correct coefficients of CO_2 and H_2O values, [1] for correct value for C_3H_4 from Data Booklet.
 $= -1939 \text{ or } -1940 \text{ kJ};$ 4
*Ignore units.
Award [4] for correct final answer.
Award [3] for +1939 or -1569.*
- (c) ~~negative; (NOT COVERED YET. LATER IN TOPIC 15)~~
~~decrease in disorder/increase in order;~~
~~5 mol of gas \rightarrow 3 mol of gas/reduction in number of gas moles;~~ 3
~~Award [1] for answer of close to zero based on use of $\text{H}_2\text{O}(\text{g})$.~~

[11]

2. $-1 \times \Delta H_1/676;$
 $1 \times \Delta H_2/-394;$
 $2 \times \Delta H_3/-484;$
 $\Delta H_4 = -202 \text{ (kJ mol}^{-1}\text{)};$ 4
*Accept alternative methods.
Correct answers score [4].
Award [3] for (+)202 or (+)40 (kJ/kJ mol⁻¹).*

[4]

3. (a) enthalpy/energy change for the formation of 1 mol of a compound from its elements;
*Do not accept **heat** needed to form 1 mol...*
in their standard states/under standard conditions/at 298 K and 1 atm; 2
- (b) greater value/more negative value;
energy given out when steam condenses/turns to water; 2
- (c) $\Delta H^\ominus = \sum \Delta H_f^\ominus (\text{products}) - \sum \Delta H_f^\ominus (\text{reactants})/\text{suitable cycle};$
 $= (-28-242)-(-201-46);$
 $= -23 \text{ kJ/kJ mol}^{-1};$ 3
*Units needed for 3rd mark.
Correct final answer scores [3].
23 or +23 kJ/kJ mol⁻¹ scores [2].
If -239 used instead of -201 for CH_3OH , award [2] for +15 kJ.*

[7]

4. C

[1]